# Strengthening Systems Engineering Execution at Boeing ..... And Meeting Customer Needs

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**6th Annual Systems Engineering Conference**

**October 23, 2003**

# Outline

- Assessment of USAF for better SE
  - Incentivizing Contractors (Excerpts from Dr. Sambur guidance)
  - Mapping of USAF SE Elements to PMBP, CMMI and SEPM
  - Joint DoD/Industry Suggested Actions
- Strengthening SE Execution at Boeing
  - Establish Management Commitment
  - Provide Infrastructure
  - Monitor and Support Execution

# Incentivizing Contractors for Better SE

Excerpts from Dr. Sambur Memo

- "An immediate transformation imperative for all our programs is to **focus more attention on the application of Systems Engineering (SE) principles and practices throughout the system life cycle**."
- "A more robust SE environment can only be achieved through joint cooperative efforts with our contractors." " SAF/AQ and all other MDAs **will not sign out any future ASPs that lack the necessary and sufficient attention to SE."**
- "Additionally, we are identifying ways to **improve SE throughout the acquisition process**, including workforce issues such as **education and training**,; **tools** such as policies, **instructions, and guidance**; and institutions such as the proposed **Center of Excellence for SE** under the Air Force Institute of Technology (AFIT)."
- "---the Air Force leadership will take a strong and renewed interest in how our acquisition community addresses SE **disciplines and practices**."

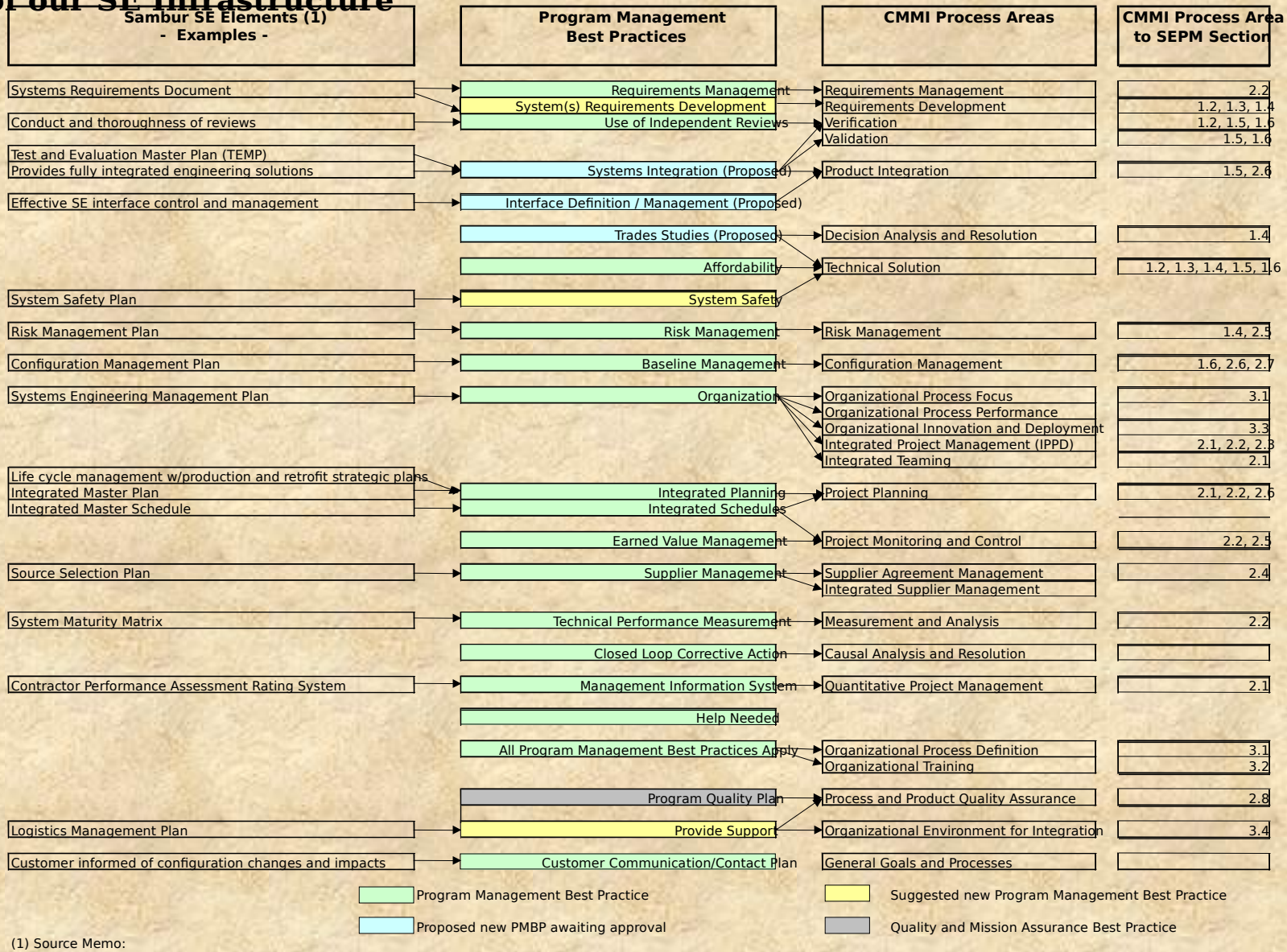
***Marvin Sambur***

**Assistant Secretary of the Air Force (Acquisition)**

**USAF Committed to Robust SE Practice for Future Acquisitions**

# Systems Engineering Execution - Boeing

## Mapping of Air Force SE Elements to PMBP, CMMI, and SEPM – existing pieces of our SE Infrastructure




(1) Source Memo:
"Incentivizing Contractors for Better Systems Engineering", dated 6 Jan 2003
from Dr. Marvin Sambur, Assistant Secretary of the Air Force for Acquisition

# Suggested Actions from the Joint DoD / Industry Meeting on SE – 11 April 2003

- SE needs to be considered across the **Program Life Cycle**
- **Develop case studies** on SE, with both good and bad program examples
- Make use of **disciplined assessment process** to monitor rate and level of SE implementation
- Recommend minimum or **normal set of SE products** or deliverables
- Create a consistent set of **SE measures/metrics**
- Define an appeal process and **take corrective action** if a program deviates from the minimum level of SE needed for sound engineering practice

# Strengthening Systems Engineering Executio

## I. Establish Management Commitment

- Command Media
- VP Engineering guidance to Chief Engineers
- EIB & PM Council direction to Bus
- Goals/Metrics

## II. Provide Infrastructure

- Comprehensive SE process assets (processes, tools, templates, etc)
- Training, SMEs
- Management tools
- SE HILT activity across sites

**Corrective Action**

## III. Monitor and Support Execution

- Oversight by SE HILT
  - SE review of proposals and programs
- Disciplined assessment process
- Metrics:
  - Monitoring Rate
  - Compliance Rate

# I. Establish Management Commitment

- Command Media
  - "Systems Engineering Process Requirements"- in-work
  - Systems Engineering Process Documents
  - Systems Engineering Process Manual
- Leadership Endorsement / Direction
  - VP Engineering advisory to site Chief Engineers emphasizing commitment to SE
  - PM Council endorsement
- Goal
  - Initiate effort to define goal/metric addressing SE execution

**Leadership Advisories and Goals will Reinforce Expectations for SE Implementation across Boeing**

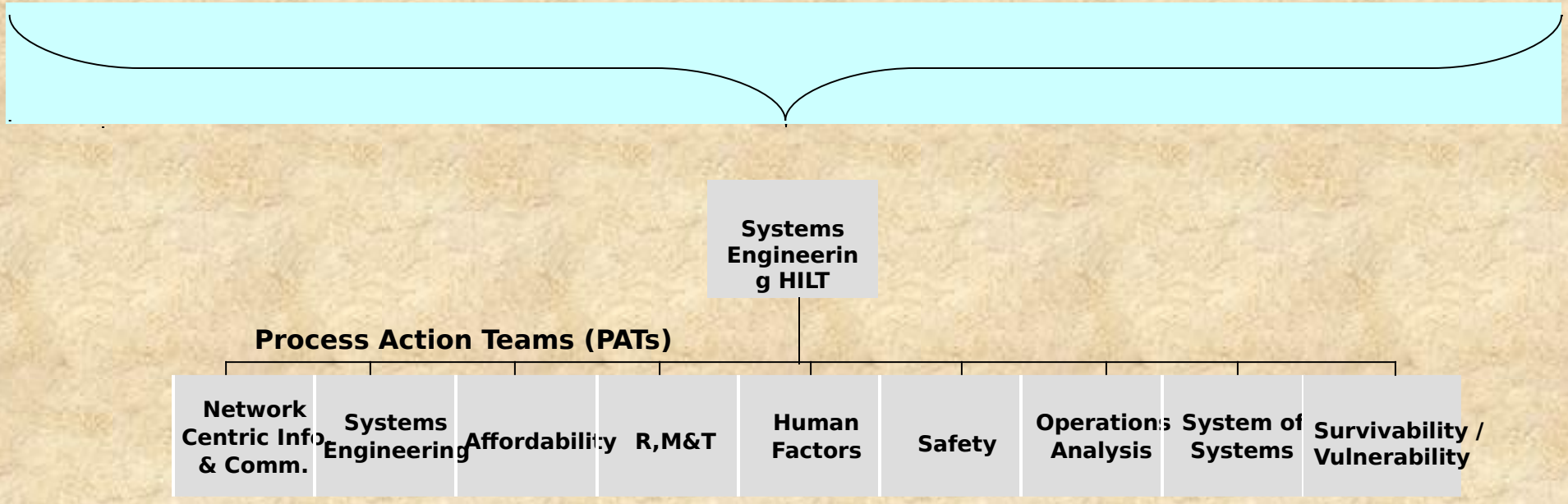
# II. Systems Engineering Infrastructure

- SE Process Assets, Management Tools
  - The SEPM outlines detailed requirements for effective SE process
  - CMMI to provide detailed set of process assets (process documentation, templates, etc)
  - Program Management Best Practices (PMBPs) address some key aspects of systems engineering
  - Gaps in Process Assets (e.g. handbooks in specialty areas) to be filled by SE Horizontal Integration Leadership Team (HILT)
- Training, SMEs
  - Considerable training in SE process exists throughout Boeing
  - The SE HILT to consolidate SE Training
  - CMMI compliant process assets in development

**SE HILT Leadership, coupled with Site CMMI activities, will ensure a comprehensive SE infrastructure**

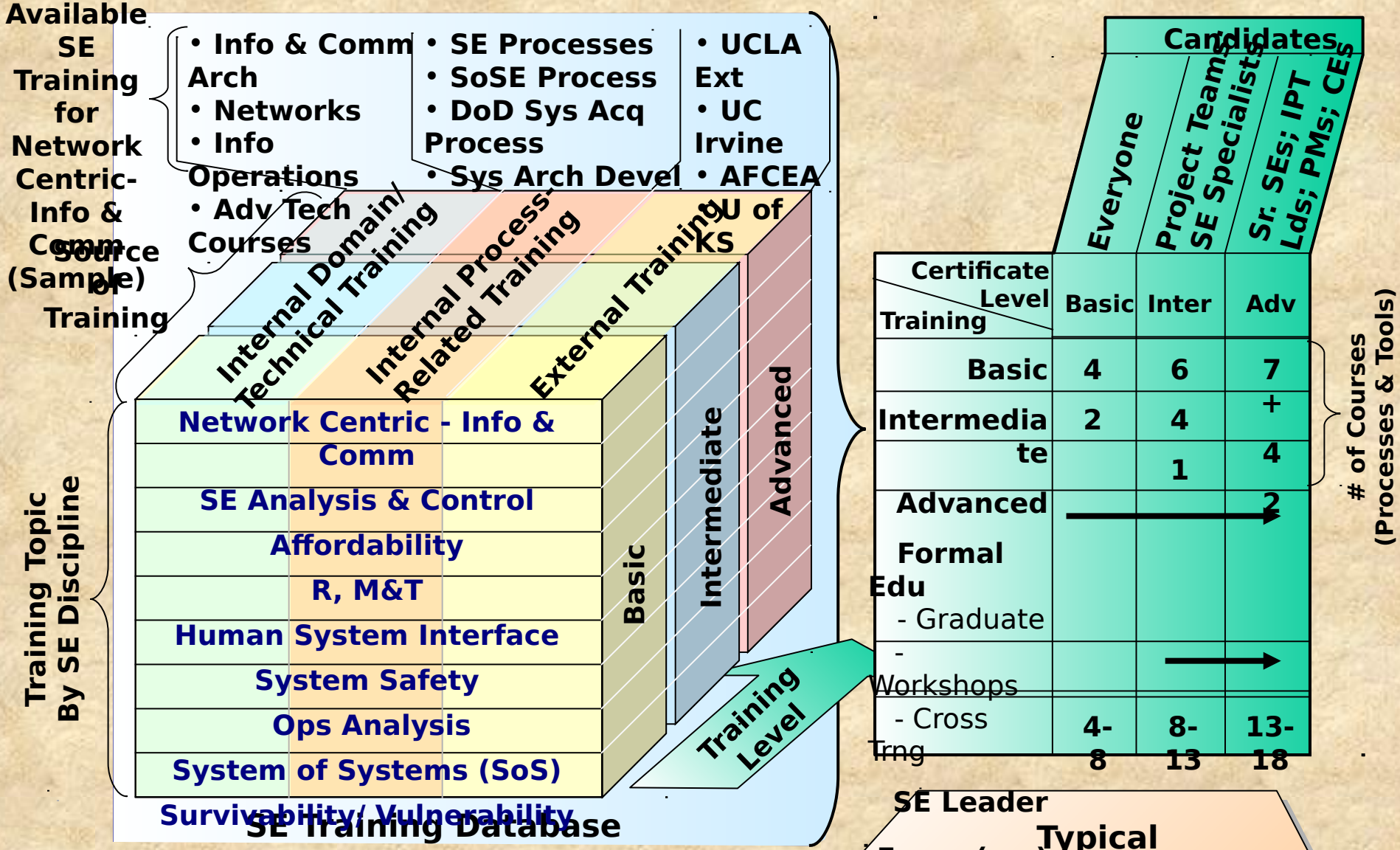
# Boeing Systems Engineering HILT / Process Action Teams (PATs)

Anaheim | Canoga Park | El Segundo | Florida | Houston | Huntington & Seal Beach | Huntsville | Long Beach | Mesa / Philly | Puget Sound | St. Louis | Wichita




**Strengthen/Integrate SE Across Boeing**

# Systems Engineering Execution - Boeing




- SE Specialists and Technical Fellows more in-depth training in a selected domain.
- IPT Leaders and Program Managers more general training across the SE disciplines.

# Available Network Centric Training (Sample)

## Network Centric Communications Training Topics

**Architectures**
- Analog vs. Digital Comm
- Comm Spectrum
- SATCOM
- Wireless Comm/ Terrestrial/ Cellular
- Laser Com
- Low Probability of Intercept
- Evolving Technologies
- Anti-jam Techniques
- Performance

**Networks**
- Internet
- Interoperability
- Performance
- Protocols/controls
- Processing Techniques
- Vulnerabilities
- Network protection

**Information Operations**
- Information assurance
- Information Warfare
- C4ISR
- Information Protection
- Processing Techniques
- Advanced/evolving technologies
- Information/data management

**In-house training plans focused in 2 areas: domain/technology training and process training**

## Network Centric Communications Training Program: Internal Process Related Training

SE Process
- Requirements Management
- Risk Management
- Trade Study Methodology

System-of-Systems Systems Engineering Process
- Detailed System-of-Systems Process
- Systems OO/UML Process
- OO Modeling in UML
- OO Analysis and Design
- SoSE Tool Kit

The DoD Systems Acquisition Process
System Architecture Development
High Level Architecture for Simulation
DII-COE
C4ISR Architecture Framework Principles and Applications

## Network Centric Communications Training Program: Internal Domain / Technology Related Training

Information & Communication Architectures
- Satellite Communications Systems
- Open Architectures
- Phased Array Antennas
- Laser Communications
- Software Architecture
- RF Subsystem Design

Networks
- Network-Centric Warfare
- Web Services

Information Operations
- Government Information Technology Thrust
- Modulation Techniques
- Working with C4ISR
- Fundamentals of Digital Signal Processing
- Time and Frequency Reference Concepts

Advanced Technology Courses
- Advanced Satellite Communications Payloads
- Satellite Network Architectures
- Advanced Fiber Optics

## Network Centric Communications Training Program: External Training

**University / Associations / Gov. Labs / Agencies / Commercial Co**

UCLA Extension – Short Course Programs
- Communications; Network Technology; Space Mission Analysis
- Satellite Communications Payloads & Systems Design
- High Frequency Satellite Communications

UC Irvine – Certificate Program
- Communications & Network Engineering (18 units required)
- Advanced Communications Systems Engineering (18 units required)

Armed Forces Communications & Electronics Association (AFCEA) – Web site courses: http://www.afcea.org/education/index.htm

Aviation & Electronics Schools of America – individual short courses (3 days)
- Fiber Optics
- Systems for RF Telecommunications
- Network Technologies and Practices

Defense Information Systems Agency (DISA) offers COE course

University of Kansas – The Information and Telecommunication Technology Center

Lawrence Livermore National Laboratory

Software/Commercial Companies offering related technology training: Versatava, Robelle, Sun Microsystems, Borland USA, Object Management Group, etc.

**Industry Seminars**
- Cisco - Networking
- Alta Vista - Search/MetaData
- Topia - Intelligent Agents
- Entrust - Security

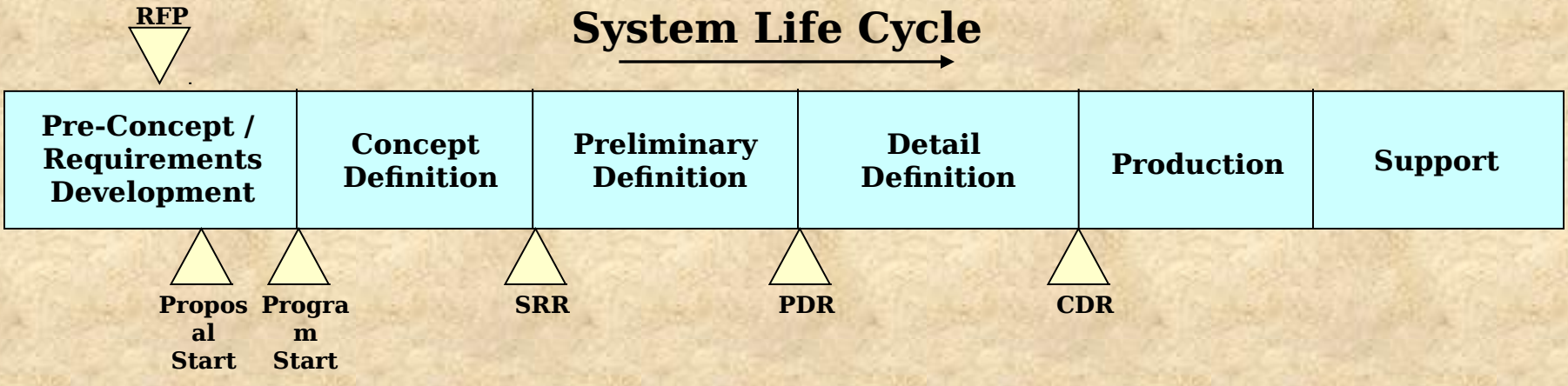
# III. Monitor and Support Execution on Proposals / Programs

1. Sites provide resources to execute SE and monitor execution.
2. SE HILT provide 'integration mechanism across Boeing'
   - Two Key Metrics to be monitored:
     - "Monitoring Rate" Metric - "Implementation Level" Metric
   - SE Evaluation Templates required for program reviews:
     - proposal coverage - kickoff planning - program in-process reviews
3. SE HILT ... metrics w... alyse... is...
4. SE HILT ... emen... corrective actions

- **Effective monitoring**
- **Root cause analysis**
- **Implementation of corrective action**

**will strengthen the execution of Systems Engineering…**
***consistent with customer desire***

# Conduct In-Progress Reviews on Progra




**Ensure SE Integrity Through Tailored Reviews during Major Program Milestones**

# The Metrics:

- "Monitoring Rate" Metric: Was the SE Process Monitoring Activity conducted?

  - Measure instances as % of opportunities.

Example: At each site, measure the number of proposals reviewed for SE compliance at Gate C as a percentage of the total number of Gate C proposals reviewed by the site.

- "Implementation Level" Metric: When the SE Process Monitoring Activity was conducted, what was the level of execution implementation?

# Boeing is Committed to SE Execution across the Enterprise